UC Davis Invasive Plant Research

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2008 Research Projects Progress Report

Developing a weed control handbook for invasive plants in California. In 2007-2008 we held several state-wide meetings with farm advisers and other weed specialists with non-crop assignations in California. Based on in-house surveys, we compiled a ranked list of the most problematic invasive plant species and assigned a set of species to each participant according to his or her area of expertise. We developed a format for the manual loosely based on similar regional manuals (e.g., the Pacific Northwest Weed Management Handbook), but with additional information reflecting the unique problems associated with invasive weed control. For example, it was felt that an herbicide susceptibility chart and sections on calibration and woody plant control methods would be beneficial. We hired a Ph.D. student, Jeremiah Mann, to conduct literature reviews and web searches on all species and to forward his sources to each participant. Participants are presently working on biology and control sections for each species, and compilation and formatting are expected to take place in 2009.

Participants include Lars Anderson (USDA), Carl Bell (UCCE San Diego County), Joe DiTomaso (UC Davis), Guy Kyser (UC Davis), Scott Oneto (UCCE Calaveras County), Steve Orloff (UCCE Siskiyou County), John Roncoroni (UCCE Napa County), Rob Wilson (UCCE Lassen County), and Steve Wright (UCCE Tulare/Kings Counties).

Restoration of invasive annual grass infested sagebrush habitat in the Great Basin region of California. In cooperation with Roger Sheley (USDA-ARS Burns Oregon), USDA-ARS (Reno), University of Nevada Cooperative Extension, and BLM, we established several research sites in the Great Basin to study the feasibility of site restoration by removal of medusahead (*Taeniatherum caput-medusae*) and cheatgrass (*Bromus tectorum*). The goal is to restore the native sagebrush scrub community and sage grouse habitat. Other researchers in this study are monitoring large-scale and small-scale trials in Nevada, Idaho, Utah, and Oregon. Our sites include two large-scale plots in Lassen and Modoc counties near Adin, and two field-scale experiments off Smoke Creek Ranch Road, Lassen County, near Susanville.

In cooperation with Rob Wilson (UCCE Lassen County), we established our large-scale plots in medusahead-infested Great Basin rangeland near Hwy 299. Imazapic was aerially applied in spring 2008. Our two field-scale sites were established in spring 2008 along Smoke Creek Ranch Road between Hwy 395 and Nevada. One site had a

dominant understory of cheatgrass and the other of medusahead. At these sites we treated 100 ft by 100 ft plots with imazapic, chlorsulfuron, and rimsulfuron in three replications.

The CDFA money was used in a cost share project with USDA and we hired a post-doctoral researcher, Jimin Zhang, to conduct the field surveys and analysis. He will monitor vegetation cover, both of the target species and of native shrubs, over a two to three year period beginning in spring 2009.

Monitoring passive restoration of native shrubs and trees following introduction of tamarisk biocontrol. In order to evaluate the impact of an introduced biocontrol insect (saltcedar leaf beetle, *Diorhabda elongata*) on smallflower tamarisk (*Tamarix parviflora*) and other vegetation in the Cache Creek watershed, we established permanent transects at three locations along Cache Creek in Yolo County: Shadow Valley Road (38°48'N, 122°10'W), Guinda Bridge (38°49'N, 122°11'W), and Low-Water Bridge (38°54'N, 122°18'W). All locations were outside or at the leading edge of beetle-infested areas. At each site, three 100-ft transects were marked with rebar stakes and recorded with GPS. In our initial evaluation (24 June 2008), we recorded dominant plant species cover along the length of each transect, as well as overstory and understory species composition, height, and cover at 10-ft intervals along each transect. We will repeat the early summer evaluation for at least three years.

Our interests in this study are (1) to monitor decline of smallflower tamarisk under leaf beetle predation, and (2) to determine whether other species tend to displace tamarisk as it declines. In addition to native shrub and tree species such as *Salix* spp. and *Populus* spp., these sites have some introduced species such as ravennagrass (*Saccharum ravennae*) and arundo (*Arundo donax*). If the decline in tamarisk tends to be taken up by introduced species, resource agencies will need to be prepared for supplemental vegetation management activities following establishment of the biocontrol agent.

Developing chemical control options for invasive plants with expanding ranges in California.

Dalmatian toadflax herbicide control. We established an experiment for evaluation of herbicide control of Dalmatian toadflax (*Linaria dalmatica*) in Ventura County at the Hungry Valley State Recreational Vehicle Park near Gorman. Applications were made at three phenological timings – early rosette (16 January 2008), just prior to flowering (22 April 2008), and post senescence (18 November 2008). Herbicides were selected on the basis of proven efficacy in other noncrop situations, with an emphasis on chemicals which have both foliar and soil residual activity, including chlorsulfuron, imazapyr, aminopyralid, dicamba, and imazapic, as well as several tank mixes. Plots were 10 ft by 30 ft and treatments were arranged in a randomized complete block design with four replications. Evaluations for treatment efficacy will be made in April 2009. We will take ratings on control, either through visual evaluation or with stem counts in quadrat subsamples, along with visual evaluations of plant vigor. At that time we will decide whether we need to conduct a further evaluation the following spring.

Rush skeletonweed herbicide control. In 2008 we conducted an experiment for evaluation of herbicide control of rush skeletonweed (*Chondrilla juncea*) in Calaveras County near Bummerville (38°23'N, 120°31'W). The site was located with the cooperation of Shawn Casteel (Calaveras County Department of Agriculture) and Scott Oneto (UCCE Tuolumne County). Although this was the largest contiguous population of skeletonweed we were able to locate, the plants were relatively sparse. We tested a new noncrop herbicide from DuPont as well as several standard treatments (Milestone, Telar) and some tank mixes. Treatments were arranged in a randomized complete block design with three replications, 10 ft by 30 ft plots, and applied in 20 GPA spray solution using a CO_2 backpack sprayer with six 8002 nozzles. Applications were made 11 April to large rosettes shortly before bolting.

We evaluated the site 1 August 2008 for control and injury. At this time, many of the plants had gone into flower or to seed. A few plants showed auxin-type injury (twisting or swelling of stems) and many showed extensive grazing damage. Owing to the sparse population and to the grazing damage, it was not possible to get a stastically significant evaluation of the treatment effects. This study will be repeated if we can locate a more appropriate site.

Scotch thistle herbicide control. In 2005, 2007, and 2008 we conducted three trials on Scotch thistle (*Onopordum acanthium*) control in Modoc County. Sites were located and established with the help of Rob Wilson (UCCE Lassen County) and Joe Moreo (Modoc County Department of Agriculture). A number of postemergence and pre/postemergence herbicides were tested, including Telar, Tordon, and the locally preferred combination Banvel + 2,4-D. We also did label testing for Milestone and efficacy screening for experimental compounds from DuPont. Treatments were applied in randomized complete blocks at both rosette and bolting stages. It was found that rosette treatments were most effective, with Banvel + 2,4-D, the high rate of Milestone, and Tordon providing the greatest control. The DuPont experimental compound MAT28 also shows potential at high rates.

Ravennagrass herbicide control. We have been attempting to locate a site along Cache Creek, Yolo County, with enough ravennagrass (*Saccharum ravennae*) plants to establish a replicated study. In the meantime, Yolo County RCD has reported success in using glyphosate and manual removal techniques.

Stinkwort herbicide control. We are looking for a site for a replicated study on stinkwort (*Dittrichia graveolens*), probably in Napa or Sonoma County, to be conducted in cooperation with John Roncoroni (UCCE Napa County).

<u>Dalmatian toadflax biocontrol monitoring.</u> In coordination with Baldo Villegas of CDFA, we established three release sites for a Dalmatian toadflax (*Linaria dalmatica*) biocontrol insect (stem-boring weevil, *Mecinus janthinus*) adjacent to the herbicide control study described above. Biocontrol release sites were 70 to 200 yards from the herbicide study. As our part in the study, we are monitoring toadflax cover and stem density at the release sites and in control sites outside the release area to evaluate impact of biocontrol agents over three or more years. At each site, we make 10 random tosses

with a 1-m quadrat and record cover and stem number. The first evaluation was taken 22 April 2008, just prior to flowering, and weevils were released in May 2008. We will conduct further evaluations at approximately the same phenological timing.

Investigate the potential for timely non-herbicidal fertilizer additions in sites with initial low density infestations of yellow starthistle and medusahead. Anecdotal reports from northern California ranchers suggest that adding timely supplemental fertilizer to rangeland can help suppress yellow starthistle (*Centaurea solstitialis*) and medusahead (*Taeniatherum caput-medusae*). In coordination with Josh Davy (UCCE Tehama, Colusa, & Glenn Counties) and Theresa Becchetti (UCCE Stanislaus County), we have established field-scale studies on working rangeland with low-level infestations of yellow starthistle and medusahead. These sites were treated with applications of fertilizer in fall 2007 in Tehama County and will be repeated at both locations in 2009 in order to enhance growing conditions for desirable forage and native vegetation.

Test the impact of aminopyralid and imazapic on native and desirable forage plants in California rangelands.

Aminopyralid field studies. Milestone has been recently introduced as a selective herbicide targeting yellow starthistle (*Centaurea solstitialis*) and other Asteraceae weeds, and it is seeing widespread use in California rangeland. We established field-scale rangeland plots in two locations in northern California to evaluate the impact of Milestone (aminopyralid) on native vegetation and desirable forage. The first experiment was established in a restored natural area in Napa County at the McLaughlin Reserve in February 2005, and the second in pasture in Solano County in 2008. At each location we applied two rates of Milestone, 3 oz and 7 oz of product per acre plus an untreated control, in 100 ft by 100 ft plots in three replications.

At the McLaughlin Reserve we evaluated treatments for three years after application, taking point-intercept transects for vegetative cover and quadrat species counts in spring. The primary goal at this site was to estimate the impact of Milestone on native herbaceous species, including susceptibility profiles and also recovery rates of sensitive natives. It was found that Milestone reduced cover of broadleaf species, particularly legumes, initially reducing species richness of native plants but enhancing cover of annual grasses. However, by 2 years after treatment, native vegetative cover and species richness were equal or higher in treated plots, largely owing to competitive release of native Liliaceae species.

In Solano County, we performed vegetative cover analysis and biomass sampling in spring 2008; evaluations will be repeated in 2009. Initial results show a great reduction in white clover (*Trifolium repens*), a desirable seeded forage species, and curly dock (*Rumex crispus*), a problem weed in pasture. We also found some suppression of desirable forage grasses at the higher rate. In spring 2009 we will reseed clover to evaluate the residual effects of Milestone.